

Physics 11: Newton's Second Law Lab

Name: _____

Objective:

Materials:

Dynamics track and car
Extra masses
Motion sensor
PasPort interface
Super pulley
String

Diagram of Apparatus:

Procedure:

Constant Mass

1. The force that accelerates the cart is the force of gravity on the end of the string. The total mass being accelerated is the sum of the mass of the cart and the mass at the end of the string. To collect 4 data runs in which the force is increased while the mass is kept constant, transfer mass from the cart to the end of the string after each run.
2. Start with 50 g on the end of the string. Hold the cart so that it is 14 cm from the motion sensor. Click “start”, release the cart. Stop the cart just before it gets to the end of the track.
3. Collect a total of 4 runs increasing the mass on the end of the string by 50 g each time.
4. Determine the acceleration experienced by the cart for each run. Enter the values in the data table.
5. Construct a graph of **force vs acceleration**.
6. Find the slope of this line.

Constant Force

7. To keep the force constant while varying the mass, the mass at the end of the string must remain the same for all runs, and the mass of the cart varies. The total mass being accelerated is still the cart and its masses plus the mass at the end of the string.
8. For each run, use a mass of **100 g** at the end of the string as the accelerating force. For the first run, use the cart only, and then add 100 g for each new trial. Determine the acceleration for each run.
9. Construct a graph of **acceleration vs mass**.

Data:

Constant mass

total mass: 0.450 kg (cart is 0.250 kg)

| x | y | |
|----------------------------|------------------|--------------------------|
| a (m/s²) | mass (kg) | F_g (N) |
| | 0.050 | |
| | 0.100 | |
| | 0.150 | |
| | 0.200 | |

Constant force

| x_1 | x_2 | y |
|-----------|---------------|-----------------------|
| mass (kg) | 1/mass (1/kg) | a (m/s ²) |
| 0.250 | | |
| 0.350 | | |
| 0.450 | | |
| 0.550 | | |
| 0.650 | | |
| 0.750 | | |

Conclusion:

1. Using the skill set on **page 946**, and your theory notes, identify the relationships shown in each graph and relate them to Newton's Second Law. State your response on each graph.
2. The slope in the **constant mass** graph represents _____.
3. What is the percent deviation between this experimental value and the actual (theoretical) value for the constant mass? (see **p. 939**)
4. Read the section on "Straightening Non-Linear Graphs" on **page 946**. Construct a graph of **acceleration vs 1/mass**.
5. What did taking the reciprocal of the x value of the **constant force** graph do to the shape of the curve?

References: _____